

Patent Claims

1. Electrotherapy apparatus for applying electrical stimulation to a muscle or group of muscles of a person or other mammal, wherein said electrical stimulation comprises electrical pulses, said electrical stimulation having parameters comprising at least some of an amplitude, a pulse repetition frequency, a duration of each pulse or group of pulses and a time offset relative to a predicted end of a T-wave of an electrocardiogram derived from said person or mammal, said offset lying in a range from 5 % of the R-R path length of the preceding heart cycle, or of an average value of the R-R path lengths of a plurality of preceding heart cycles, or of a representative R-R path length, before the predicted end of said T-wave up to 45 % of the R-R path length of the preceding heart cycle, or of an average value of the R-R path lengths of a plurality of preceding heart cycles, or of a representative R-R path length, after the predicted end of the T-wave,
characterised in that
the electrotherapy apparatus is adapted to vary at least one of said amplitude, said pulse repetition frequency, said duration and said offset in accordance with a predetermined pattern, or randomly, within pre-specified limits in the course of a treatment extending over many heart cycles, typically over more than 15 minutes.
2. Electrotherapy apparatus in accordance with claim 1,
characterised in that
said amplitude variation can amount to a variation in peak voltage of said electrical stimulating pulses in a range from +1 or -1 V to

+10 or -10 V from a nominal value selected in the range from typically 10 to 50 V.

3. Electrotherapy apparatus in accordance with claim 1 or claim 2, characterised in that
said pulse repetition frequency lies in a range from 20 to 1000 Hz, preferably in a range from 30 to 250 Hz, and in that said pulse repetition frequency can be varied within said range.
4. Electrotherapy apparatus in accordance with any one of the preceding claims,
characterised in that
said pulse duration lies in the range from 0.1 ms to 600 ms and can be varied in this range.
5. Electrotherapy apparatus in accordance with any one of the preceding claims,
characterised in that
an interval between successive pulses can lie in a range from 0.1 ms to 50 ms and can be varied in this range.
6. Electrotherapy apparatus in accordance with any one of the preceding claims,
characterised in that
said offset can lie within said range from 5 % of the R-R path length of the preceding heart cycle, or of an average value of the R-R path lengths of a plurality of preceding heart cycles, or of a representative R-R path length, before the predicted end of said T-wave up to 45 % of the R-R path length of the preceding heart cycle, or of an average value of the R-R path lengths of a plurality of preceding heart cycles,

or of a representative R-R path length, after the predicted end of the T-wave, and can be varied in this range.

7. Electrotherapy apparatus in accordance with any one of the preceding claims,
characterised in that a plurality of said parameters are simultaneously varied.
8. A method for applying electrical stimulation to a muscle or group of muscles of a person or other mammal using electrotherapy apparatus, wherein said electrical stimulation comprises electrical pulses, the electrical stimulation having parameters comprising at least some of an amplitude, a pulse repetition frequency, a duration of each pulse or group of pulses and a time offset relative to a predicted end of a T-wave of an electrocardiogram derived from said person or mammal, said offset lying in a range from 5 % of the R-R path length of the preceding heart cycle, or of an average value of the R-R path lengths of a plurality of preceding heart cycles, or of a representative R-R path length, before the predicted end of said T-wave up to 45 % of the R-R path length of the preceding heart cycle, or of an average value of the R-R path lengths of a plurality of preceding heart cycles, or of a representative R-R path length, after the predicted end of the T-wave,
characterised in that
at least one of said amplitude, said pulse repetition frequency, said duration and said offset is varied in accordance with a predetermined pattern, or randomly, within pre-specified limits in the course of a treatment extending over many heart cycles, typically over more than 15 minutes.

9. A method in accordance with claim 8,
characterised in that
said amplitude variation is selected to amount to a variation in peak voltage of said electrical stimulating pulses in a range from +1 or -1 V to +10 or -10 V from a nominal value selected in the range from typically 10 to 50 V.
10. A method in accordance with claim 8 or claim 9,
characterised in that
said pulse repetition frequency is selected to lie in a range from 20 to 1000 Hz, preferably in a range from 30 to 250 Hz, and in that
said pulse repetition frequency is varied within said range.
11. A method in accordance with any one of the preceding claims 8 to 10,
characterised in that
said pulse duration is selected to lie in the range from 0.1 ms to 600 ms or smaller and is varied within this range or in a smaller range.
12. A method in accordance with any one of the preceding claims 8 to 11,
characterised in that
an interval between successive pulses is selected to lie in a range from 0.1 ms to 50 ms or smaller and is varied in this range or in a smaller range.
13. Method in accordance with any one of the preceding claims 8 to 12,
characterised in that
said offset is selected to lie within said range from 5 % of the R-R path length of the preceding heart cycle, or of an average value of

the R-R path length of a plurality of preceding heart cycles or of a representative R-R path length, before the predicted end of said T-wave up to 45 % of the R-R path length of the preceding heart cycle, or of an average value of the R-R path length of a plurality of preceding heart cycles, or of a representative R-R path length, after the predicted end of the T-wave, and is varied in this range or in a smaller range.

14. Method in accordance with any one of the preceding claims 8 to 13, characterised in that
a plurality of said parameters are simultaneously varied.